Headquarters U.S. Air Force

Integrity - Service - Excellence

Advancing Green Remediation Cleanup Practices in the Air Force

U.S. AIR FORCE

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12 May 2011, E2S2

New Orleans, LA

Report Documentation Page

Form Approved
OMB No. 0704-0188

1. REPORT DATE	2. REPORT TYPE	3. DATES COVERED
12 MAY 2011		**00-00-2011 to 00-00-2011**

4. TITLE AND SUBTITLE	5a. CONTRACT NUMBER
Advancing Green Remediation Cleanup Practices in the Air Force	5b. GRANT NUMBER
	5c. PROGRAM ELEMENT NUMBER
6. AUTHOR(S)	5d. PROJECT NUMBER
	5e. TASK NUMBER
	5f. WORK UNIT NUMBER
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) **Air Force Center for Engineering and the Environment,AFCEE/TDN,2261 Hughes Ave,Lackland AFB,TX,78236-9853**	8. PERFORMING ORGANIZATION REPORT NUMBER
9. SPONSORING/MONITORING AGENCY NAME(S) AND ADDRESS(ES)	10. SPONSOR/MONITOR'S ACRONYM(S)
	11. SPONSOR/MONITOR'S REPORT NUMBER(S)

12. DISTRIBUTION/AVAILABILITY STATEMENT
Approved for public release; distribution unlimited

13. SUPPLEMENTARY NOTES
Presented at the NDIA Environment, Energy Security & Sustainability (E2S2) Symposium & Exhibition held 9-12 May 2011 in New Orleans, LA.

14. ABSTRACT

15. SUBJECT TERMS

16. SECURITY CLASSIFICATION OF:			17. LIMITATION OF ABSTRACT	18. NUMBER OF PAGES	19a. NAME OF RESPONSIBLE PERSON
a. REPORT	b. ABSTRACT	c. THIS PAGE			
unclassified	**unclassified**	**unclassified**	**Same as Report (SAR)**	**31**	

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Outline

- AF sustainability goals and drivers
- “Green” status in the AF Environmental Restoration Program (ERP)
- Opportunities for Green and sustainable remediation in the AF ERP
- GSR tools
- GSR in AF contracts
- Case studies (active, ANG, BRAC) of GSR technologies and approaches

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AF Overview – Mission of AF

- **AF Mission: *Fly, fight* and *win* ... in air, space, and cyberspace**
- **AF Vision:**
  - **Be trusted and reliable joint partner with sister services**
  - **Known for integrity in all activities, including supporting joint mission first and foremost**
  - **Provide compelling air, space, and cyber capabilities for use by the combatant commanders**
  - **Excel as stewards of all Air Force resources in service to the American people, while providing precise and reliable Global Vigilance, Reach and Power for the nation**

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AF Sustainability Goals/Drivers

The mission of the DoD is more than aircraft, guns, and missiles…Part of the defense job is protecting the land, waters, timber and wildlife, the priceless natural resources that make this great nation of ours worth defending.

- Former Chief of Staff of the Air Force Gen. Thomas D. White - An early visionary

We are dedicated to the responsibility of finding solutions which support and enhance operations while protecting natural resources…We recommit to this responsibility by taking action today for a greener tomorrow… Through energy conservation and energy efficiency initiatives, we continue to work toward reducing usage and cost.

Terry A Yonkers, Assistant Secretary of the Air Force for Installations, Environment and Logistics
27 March 2010

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AF Sustainability Goals/Drivers

2005

Aug 2005 | **Energy Policy Act of 2005 (EPAct05)**
- New facilities, 30% more efficient than ASHRAE 90.1
- Use of advanced meters

2006

Jan 2006| **Federal Leadership in High Performance and Sustainable Buildings MOU (HPSB)**
- Establish *Guiding Principles* for new construction
- DoD was first voluntary signatory

Jan 2007| **Executive Order 13423: Strengthening Federal Environmental, Energy and Transportation Management**
- Reduce energy consumption 30% by 2015
- Reduce water use 16% by 2015
- All new construction must incorporate HPSB principles
- 15% of existing buildings must be HPSB by 2015

2007

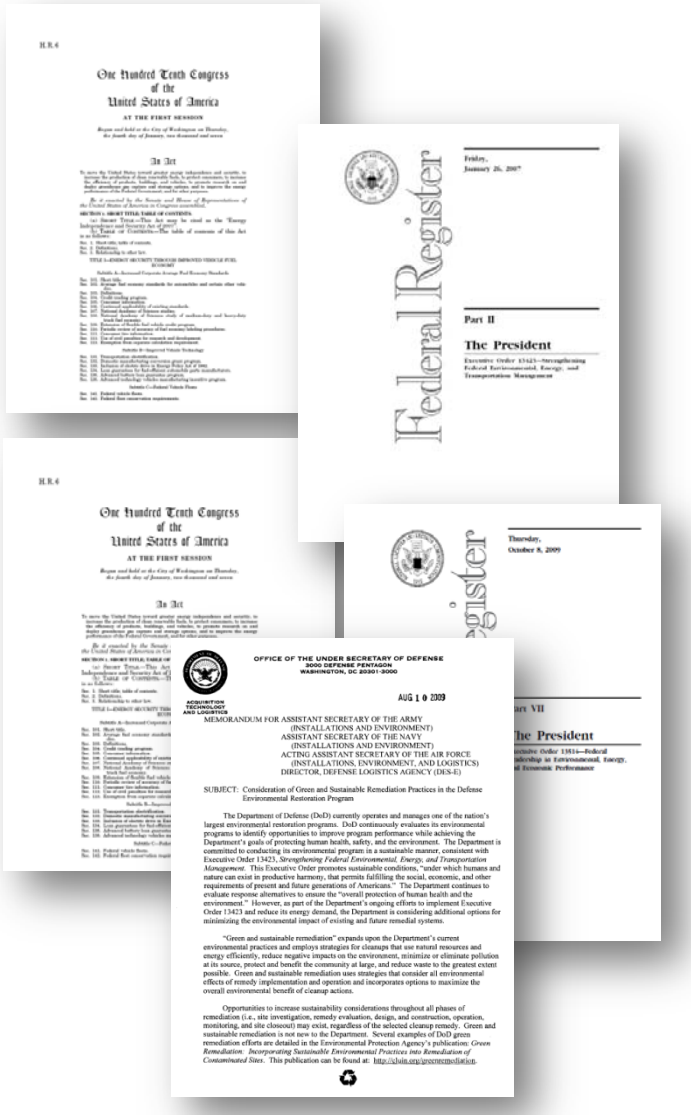
Dec 2007| **Energy Independence and Security Act (EISA)**
- New facilities reduce fossil fuel generated energy, 55% by 2010 – 100% by 2030
- 30% hot water supplied by solar water heaters
- Restore predevelopment hydrology
- Identification and use of a green building rating system

2008

Aug 2009 | **OSD Green and Sustainable Remediation Memorandum**
- DoD components to consider green remediation opportunities when and where make sense

2009

Oct 2009| **Executive Order 13514: Federal Leadership in Environmental, Energy and Economic Performance**
- GHG reporting requirements for scope 1, 2, 3
- Each agency shall develop, implement, and annually update an integrated Strategic Sustainability Performance Plan



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AF Environmental Restoration Program

- **Installation Restoration Program (IRP) – 572 sites in 2010**
  - **6,078 sites closed, response complete, or RIP**
  - **Cleanup of pre-1986 contaminated sites**
  - **Achieve Remedy-in-Place (RIP) by 2012**
- **Compliance Restoration Program (CRP) – 952 sites in 2009**
  - **Compliance cleanup sites (post-1986 releases)**
- **Military Munitions Response Program (MMRP) – 455 open munitions response sites**
  - **Cleanup of non-operational ranges**
  - **Achieve RIP/Response Complete (RC) by 2020**
- **FY10 Budget: $414M for 648 active projects**

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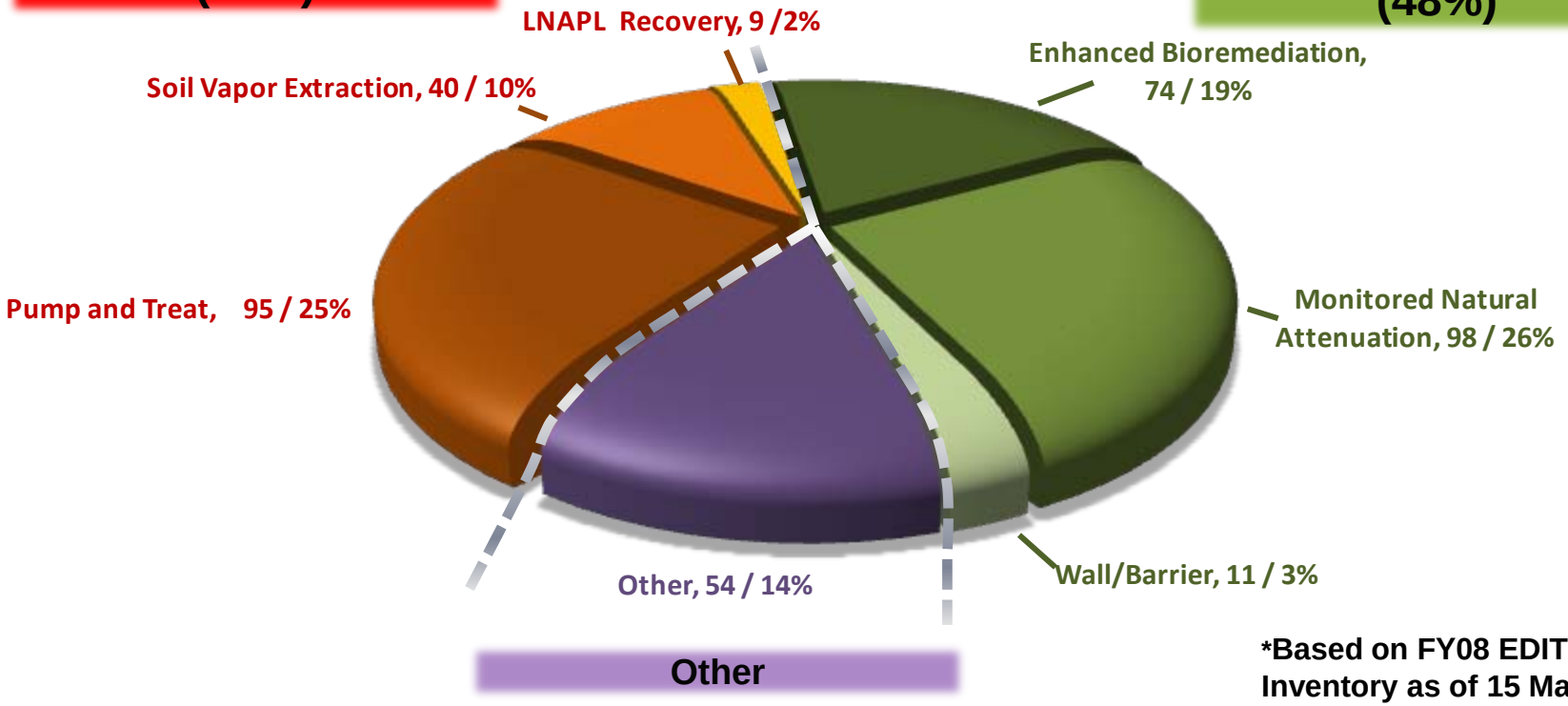
AF Environmental Restoration Program

System Inventory:
381 Remedial Systems in Operation*

Energy Intensive (38%)

Low Energy/Passive (48%)



*Based on FY08 EDITT System Inventory as of 15 March 2010

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AF Environmental Restoration Program

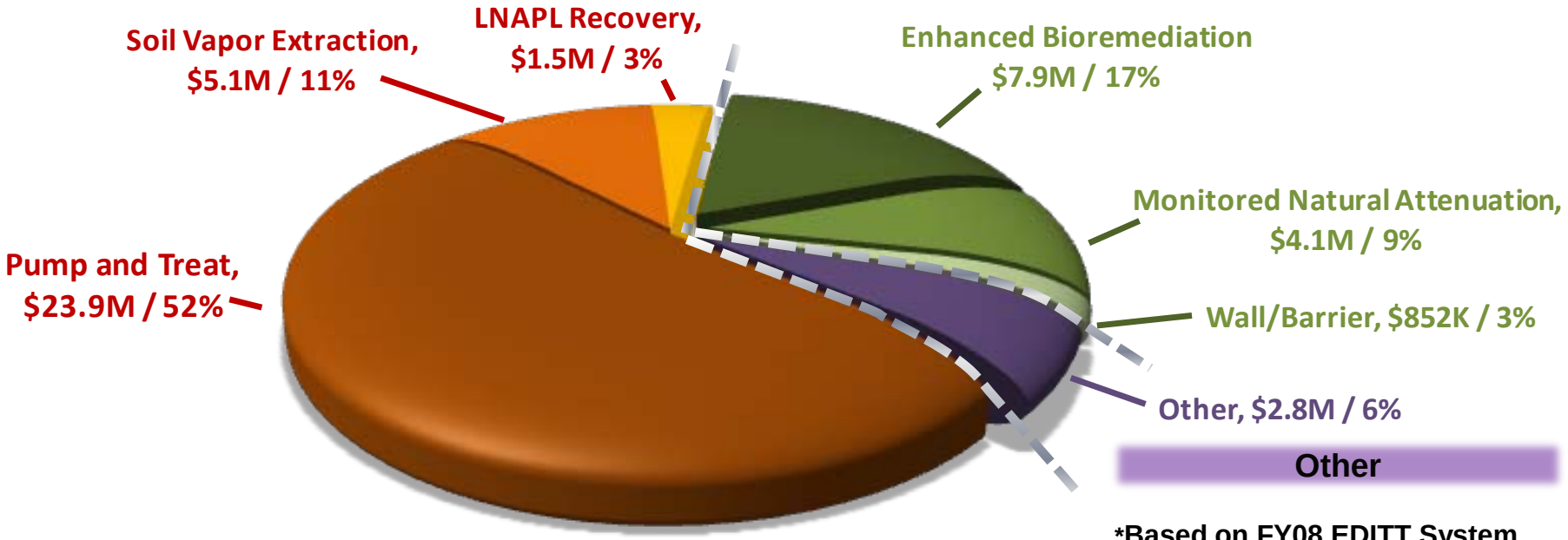
System Inventory Costs
381 Remedial Systems in Operation*

38%

48%

Energy Intensive
(66% annual costs)
(73% LCC)

Low Energy / Passive
(28% annual costs)
(24% LCC)



*Based on FY08 EDITT System Inventory as of 15 March 2010

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GSR in AF ERP

- **Overarching goal – protect human health and environment**
  - **Practice of considering all environmental effects of remedy implementation and operation incorporating options to minimize the environmental footprint of a cleanup**
- **Key elements of the GSR initiative to minimize:**
  - ***Energy use for treatment systems***
  - ***Water use/impacts on water resources***
  - ***Material consumption/waste generation***
  - **Impacts on *land* and *ecosystem***
  - ***Air* emissions**
- **Objective – Incorporate GSR technologies as part of holistic approach to optimize cleanup**

GSR in AF ERP

Goals

- Accelerate greener Remedy-in-Place (RIP)
- Augment current remedies to achieve Site Closure (SC)
- Lower capital and O&M costs
- Move from energy-consumptive to energy-efficient technologies
- Promote education and transfer of successful solutions and lessons learned

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GSR Tool – Optimization

Environmental Restoration Program Optimization (ERP-O)

- A ***comprehensive and systematic*** review of an installation's cleanup activities
- Return natural infrastructure resources to ***beneficial use***
- Promote and incorporate ***sustainability principles***
- Ensure remedy ***effectiveness***, first
- Optimize remedy ***efficiency***, second

Focus is on PERFORMANCE … which drives COSTS

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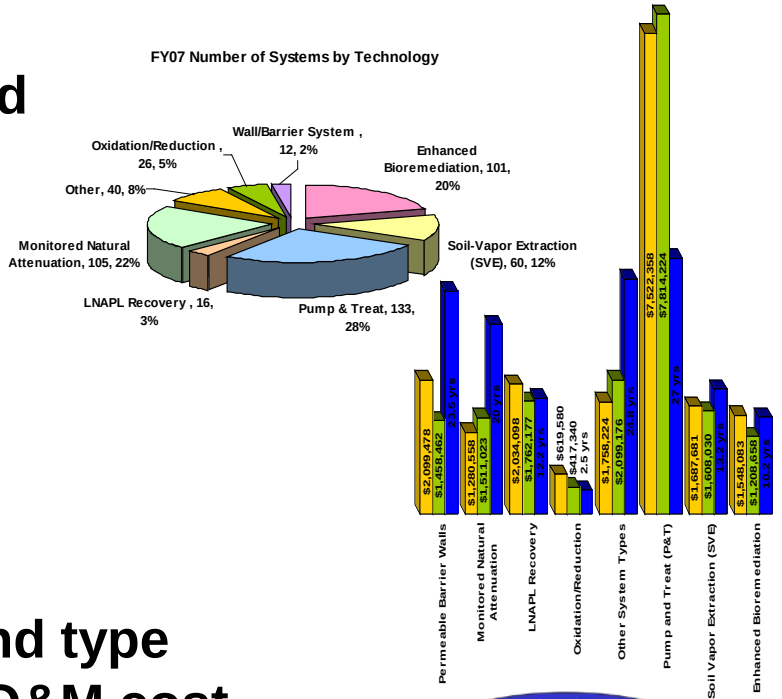
GSR Tool – EDITT

Environmental Decision Information Tracking Tool (EDITT)

- AF enterprise database
  - System & technology inventory and performance data
  - Site inventory, green and sustainable transformation
  - Land use control data
  - Decision document inventory
  - Optimization and emerging Issues
- Results
  - Better understanding of number and type of remediation systems/LTM, and O&M cost for each
  - *Flags systems not GSR-oriented for focused optimization/evaluation*



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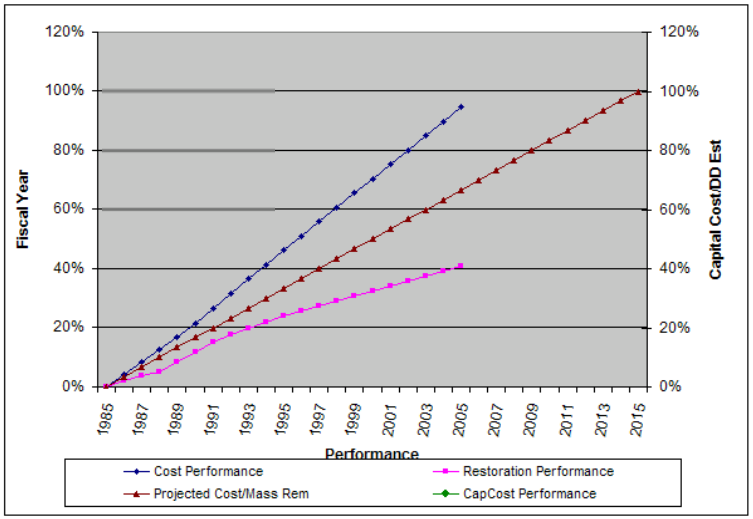
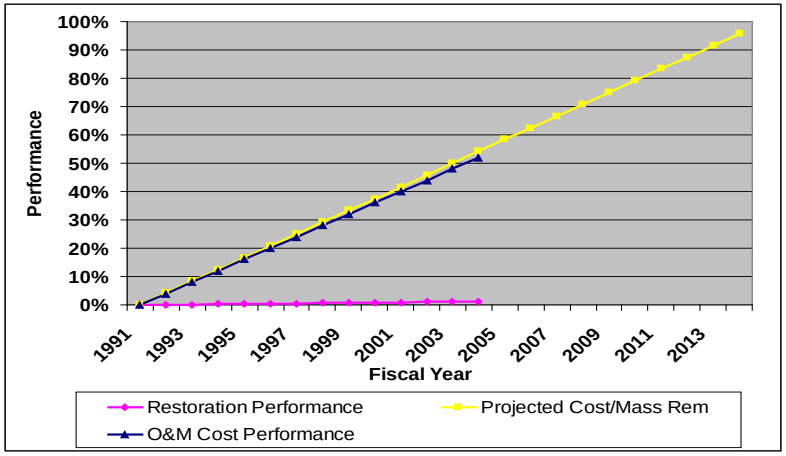
GSR Tool – Performance Tracking Tool

- Analyzes performance sustainability of existing remediation systems
- Track remedy's performance and cost
- Normalized output for easy comparisons
- Example Technologies
  - Bioslurping
  - Monitored Natural Attenuation (MNA)
  - Surfactant Extraction
  - Soil Vapor Extraction (SVE)
  - Dual Phase – SVE & P&T





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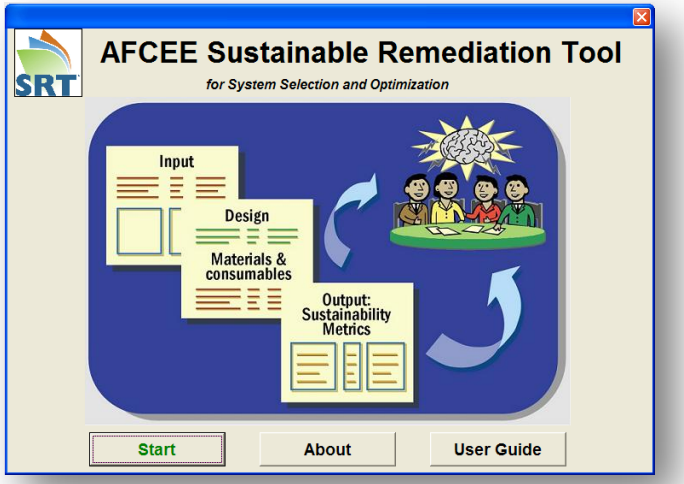
GSR Tool – CleanSWEEP

- Design and decision tool for alternative energy use in site remediation: Clean Solar and Wind Energy in Environmental Programs
- Easily applicable to remote sites, systems with low energy requirements over long periods, systems which do not require continuous operation
- Help ER RPMs decide on use of renewable energy
- Simple enough to be used "out-of-the-box" with little training
- Sophisticated enough to make go/no-go and simple design recommendations for small to mid-sized systems
- Appropriate as screening tool for large and complex ($$$) systems

GSR Tool – SRT

Sustainable Remediation Tool (SRT)

- Free, Excel-based tool developed by AFCEE
- Optimization tool as well as helps drive and influence GSR technology selection
- Used in future planning and optimization of existing systems
- Provides lifetime sustainability assessment
- Works in concert with PTT to evaluate performance and reduce time to site closure
- Technology module based: Excavation, SVE, P&T, EISB, ISCO, PRB, MNA/LTM, thermal



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GSR Tool – SRT

Design principles

- No replication of design tools (simply calculate metrics)
- Develop with tiered approach for parameter inputs
  - Easy Tier 1 with Rules of Thumb for technology estimates
    - 1 to 2 hours; most appropriate for FS
  - Tier 2 can estimate but not intended to replace design tools
    - 1 to 2 days; most site-specific results, more overrides, most appropriate after FS, more appropriate for optimization
  - Allow user override of estimated values at any time to accommodate real design parameters
- Includes cost as a sustainability metric

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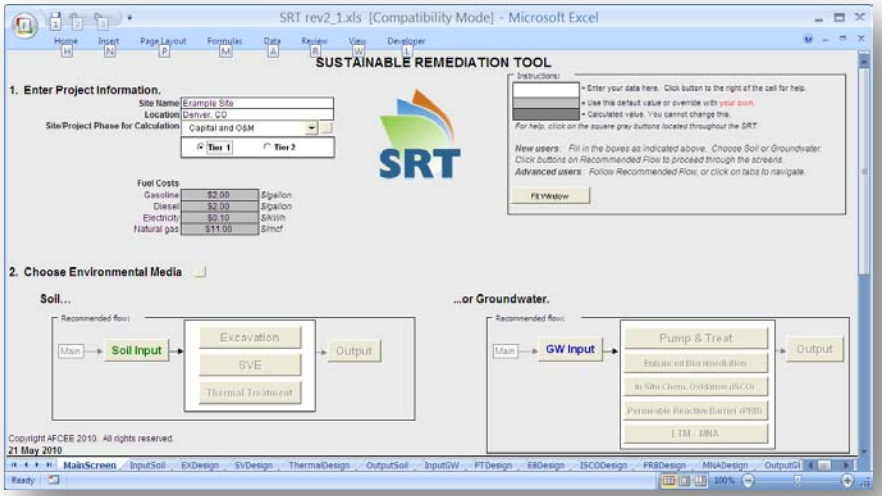
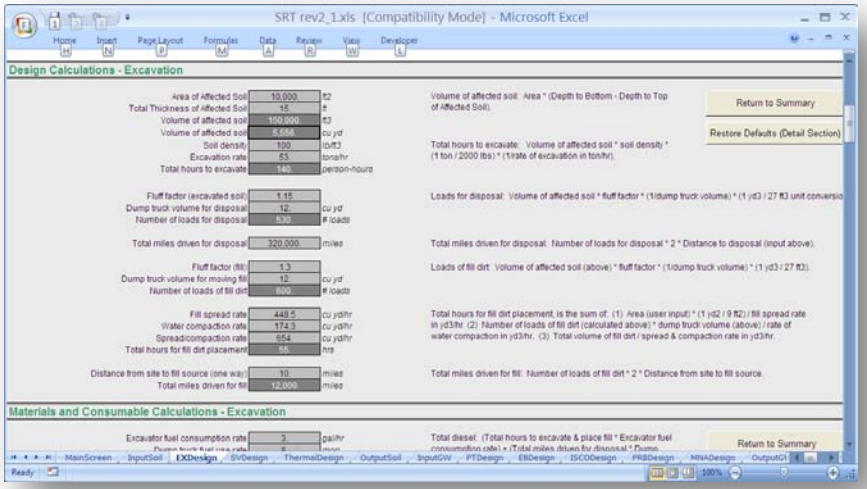
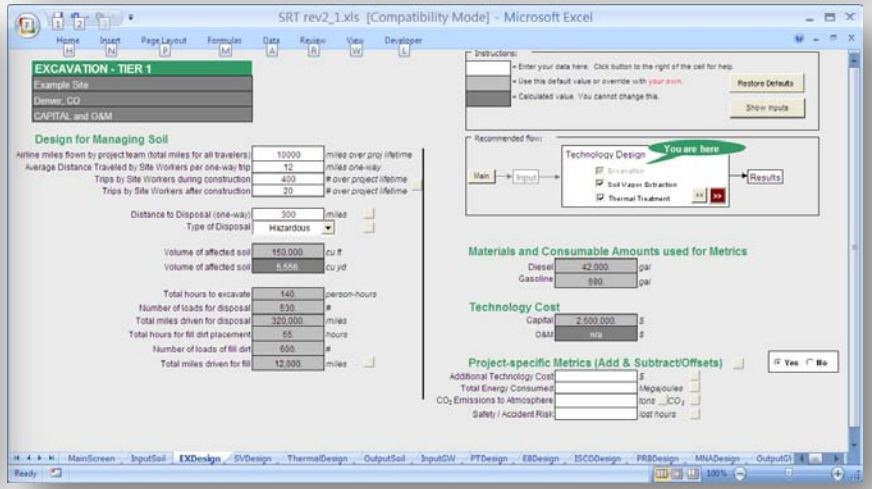
GSR Tool – SRT

SRT Metrics

- Emissions to atmosphere
  - CO_2 , NO_x , So_x , PM_{10}
- Total energy consumed
- Change in resource service
- Technology cost
- Safety / Accident risk



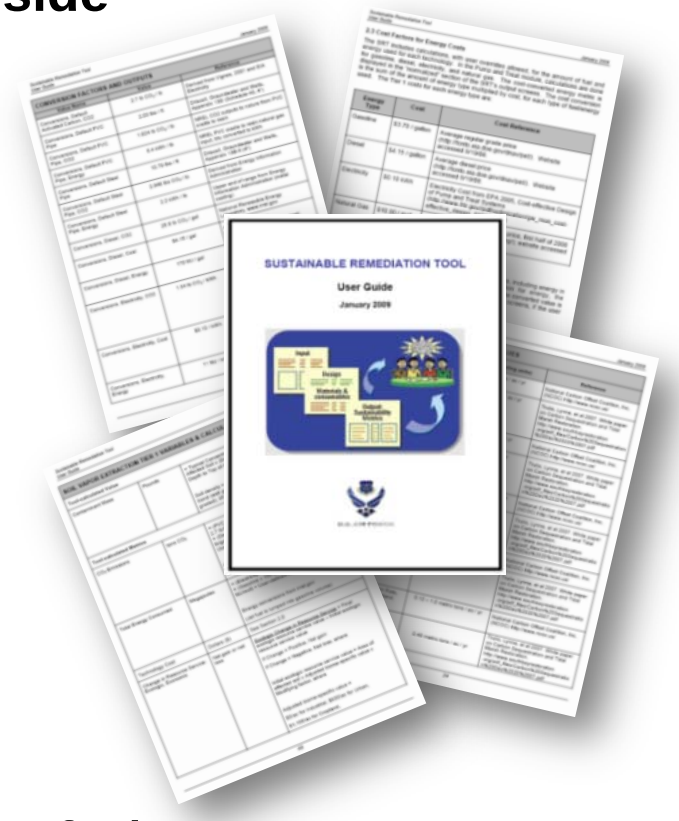




GSR Tool – SRT

SRT Strengths

- Screens / Compares technologies side-by-side
  - Up to 8 different technologies at once
- Scenarios feature
- Stakeholder roundtable feature
- Capable of using inputs from design tools
- Validated costing model (RACER™) interaction in next release
- Partnering with Environment Canada
- Proposed for Australian baseline
- Included in ANG GSR policy
- Download for free at www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremediation



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GSR in Contracts

- To date, GSR language in many AFCEE contract vehicles (4P-AE, GEITA, WERC, ECOS) and ANG efforts
- Concerted effort to include GSR language in upcoming PBR contracting actions from AFCEE
  - Factor 1, Subfactor 1 – Understanding of Work
  - Factor 1, Subfactor 2 – Risk Management Approach
  - Factor 1, Subfactor 3 – Sustainable Practices
  - Factor 2, Relevant Experience
  - Factor 3, Managerial Approach

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GSR in Contracts – Results

- General consensus amongst execution/contracting to include GSR
  - However, education needed and guidance needed
- Language going into contracts; developing matrix on how to measure results and reporting
- Tinker, Tyndall, Barksdale, Loring/Pease, Kelly, and FE Warren actions released
- Issues being worked:
  - How is sustainability tracked?
  - What is tracked?
    - Must have meaning toward AF sustainability goals
  - Incorporate into existing reporting deliverables

Score	Aggressiveness of targets*			
	Example GSR indicators and targets			
	Indicator	Reduction target**	Indicator	Increase target**
Exceptional	Examples: - Greenhouse gas emissions - Natural resource consumption - Accident risk - Energy consumption - Criteria pollutant emissions	e.g. 50-100%	Examples: - Debris and materials reuse/recycling - Renewable energy consumption - Materials extracted, manufactured and/or purchased locally - Local labor employment - Wastewater reuse/recycling	e.g. 10-100%
Good		e.g. 25-49%		e.g. 5-10%
Acceptable		e.g. 10-24%		e.g. 2-5%
Marginal		e.g. 5-9%		e.g. 1-2%
Unacceptable		e.g. 0-5%		e.g. 0%

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GSR in AF ERP through Technology

Broad Agency Announcement (BAA) for USAF Environmental Restoration Program Innovation

- Contract mechanism for dem/val of innovative technologies
  - Identify BETTER, FASTER, CHEAPER, & GREENER solutions
  - Awards based on: technical merits and broad spread application
  - $3M-$4M/yr AFCEE -- leveraged -- $36M (total) SERDP/ESTCP
  - $4M current funding focuses on/has GSR applications
  - Most recent release – Week of 14 March 2011
    - Appears in FedBizOps


Solar-powered aerator, KSC, FL


Vegetable oil injection, Dover AFB, DE


Biowall, Altus AFB, OK


Solar-powered extraction well, Travis AFB, OK

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AF GSR Case Study – Altus AFB, OK

Biowall

- **Primary objective – degrade TCE & other chlorinated compounds as pass through biowall**
- **Interim corrective action to replace P&T system**
- **Reductions in TCE averaging 86 percent**
- **System has been replenished**

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AF GSR Case Study – Travis AFB, CA

Solar-powered biological/chemical source area treatment system – in situ bioreactor

- **Mix mulch, gravel, iron and gypsum promote reductive dechlorination and abiotic reduction**
- **Selected as GSR case study by EPA Region 9**
- **BAA demo in PBC environment**
- **Additional bioreactors to be installed on base**
- **Targeted for RIP**

AF GSR Case Study – MMR (39% Renewable Energy)

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Easy pickin's

- **Installed more efficient motors = >$100K***
- **Replaced sodium vapor overhead lighting = $53K***
- **Eliminated booster pumps and downsized pump motors = >$45K***
- **Used bio-diesel = $2K***
- **Reduced propane use = $1.5K***
- **Installed low-wattage heaters = $500***
- **Misc energy (motion sensors, lighting replacement, programmable thermostats, LED exit lighting, etc.) = $170***
- **Signed up with load reduction program (demand response program)**

*Dollars Represent Estimated Annual Savings

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AF GSR Case Study – MMR

Wind turbine construction (‘07 – ’09)

- **Contract awarded Sep 2007, $4.6M**
- **Massachusetts Technology Collaborative (MTC) Grant of $300K awarded to AF**
- **Contributed 1,642 MWHs of groundwater cleanup program’s total 9,769 MWHs of electric usage (17%)**
- **MMR’s goal – reach 100% net on-site renewable use in 2014 with combination of two additional wind turbines (coming on-line in 2011) and continued system optimization**

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AF GSR Case Study – Tucson, AZ

162nd Fighter Wing, Tucson, AZ

- Groundwater extraction, treatment & recharge system
  - 1997 – March 2010 P&T 708M gal to remove ~ 37 lb TCE (3 gal)
    - 1 gal TCE removed for every 234,000,000 gal extracted
    - Apr 2009 – March 2010 influent ranges between 4.3 – 5.5 ug/L
- Averages based on 2008 GSR evaluation
  - Avg monthly energy consumption 22K kWh or 265K kWh per year (2.34% base annual consumption)
  - 249 metric tons CO_2 equivalents (e) emitted based on energy use
  - 14 metric tons (MT) CO_2 based on transportation
  - About 9 miles of polyethylene tubing (PET) used annually

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AF GSR Case Study – Tucson, AZ

- **Assessment recommendations:**
  - Discontinue non-contributing wells
  - Switch from air stripper to GAC
  - Use passive treatment (e.g., ISCO) and sampling
  - Reduce sampling frequency and associated waste
  - Use solar power for GWETRS
  - Recharge aquifer
- **GSR actions:**
  - Findings presented to USEPA Region 9, August 2009
  - In-situ Chemical Oxidation (ISCO) pilot test conducted in 2009
  - USEPA Region 9 and ANG working toward goal of shutting GWETRS down in favor of more sustainable approach

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New AFRPA initiative

- AFRPA partnering with AFCEE and AFCESA, investigating EUL opportunities on IRP sites
- Great opportunity to bring value back to Air Force and establish relationships/positive image with surrounding community
- Potential funding source for restoration clean up (in-kind consideration)
- Restoration sites may be best option for EUL projects on installations where open land is limited
- Solar projects require shallow foundations or can have footings created that sit on surface
- Great success story for AF to clean up hazardous sites and replace them with renewable energy projects

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Wrap-up

- Nearly half remediation systems in place are passive, low-energy intensive technologies; however…
  - Large number of systems are not
  - Opportunities exist for optimization
  - Color of money prevents collaboration between programs
  - Remediation decisions not necessarily based on sustainability
  - Contracting language now calling for GSR considerations
  - DoD agencies, federal and state regulators more educated and generating policies defining/guiding/requiring GSR considerations
- SRT, PTT, SiteWise and other tools free and available for use

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Resources

- **PTT: www.afcee.af.mil/resources/restoration/erp-o**
- **SRT: www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremediation/srt**
- **SiteWise: www.ert2.org/t2gsrportal/SiteWise.aspx**
- **AFCEE: www.afcee.af.mil/resources/technologytransfer/programsandinitiatives/sustainableremeditation**
- **Navy: http://www.ert2.org/t2gsrportal**
- **Army Framework: www.environmental.usace.army.mil/pdf/IG%2010-01%2003_05_10%20doc.pdf**
- **EPA: www.clu-in.org/greenremediation**
- **ITRC: www.itrcweb.org/teampublic_GSR.asp**
- **SERDP/ESTCP: www.estcp.org & www.serdp.org**
- **SURF: www.sustainableremediation.org**

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Questions?